

CLAIMS

1. An electrolyte membrane-electrode assembly comprising a pair of electrodes and a hydrocarbon-based solid polymer electrolyte membrane sandwiched therebetween
5 wherein the glass transition temperature of the electrolyte membrane in a dry state is not lower than 160°C and the maximum water content of the electrolyte membrane is within the range of from 10% to 120%.

10 2. The electrolyte membrane-electrode assembly according to claim 1, wherein the periphery of each of the pair of electrodes is formed of a sealing member.

15 3. The electrolyte membrane-electrode assembly according to claim 1, wherein an electrolyte membrane is used which is a hydrocarbon-based ion exchange membrane having an ion exchange capacity (IEC) within the range of from 1.0 to 3.0 meq/g and exhibits a conductivity, measured under an atmosphere at 80°C and 95% relative humidity, of 0.01 S/cm or more, and in which electrolyte membrane the water absorption at 80°C (W80°C), the water absorption at 25°C (W25°C) and the ion exchange capacity (IEC) satisfy the following formula (1):

$$(W80^{\circ}\text{C}/W25^{\circ}\text{C}) \leq (\text{ICE}) + 0.05 \quad (\text{formula (1)})$$

20 W80°C: water absorption (% by weight) at 80°C

W25°C: water absorption (% by weight) at 25°C

IEC: ion exchange capacity (meq/g)

25 4. The electrolyte membrane-electrode assembly according to claim 3, wherein an electrolyte membrane is used that comprises a sulfonic acid group-containing hydrocarbon-based solid polymer compound which is a hydrocarbon-based solid polymer having a sulfonic acid group content (an ion exchange capacity based on the polymer structure) of 2.0 meq/g or more and which exhibits a moisture absorption (λ)

defined as the number of water molecules per sulfonic acid group under an atmosphere at 80°C and 95% relative humidity of a value less than a relation (sulfonic acid group content)×6 - 2.

5 5. The electrolyte membrane-electrode assembly according to claim 3, wherein an electrolyte membrane is used which is a hydrocarbon-based ion exchange membrane having an ion exchange capacity within the range of from 1.0 to 3.0 meq/g and exhibits a conductivity, measured under an atmosphere at 80°C and 95% relative humidity, of 0.01 S/cm or more and in which the water absorption at 80°C of the electrolyte membrane
10 (W80°C) and the ion exchange capacity satisfy the following formula (2):

$$W80^{\circ}\text{C} < 4.0 \times (\text{IEC})^{5.1} \text{ (formula (2))}$$

W80°C: water absorption (% by weight) at 80°C

IEC: ion exchange capacity (meq/g)

15 6. The electrolyte membrane-electrode assembly according to claim 3, wherein an electrolyte membrane is used which is a hydrocarbon-based ion exchange membrane having an ion exchange capacity within the range of from 1.0 to 3.0 meq/g and exhibits a conductivity, measured under an atmosphere at 80°C and 95% relative humidity, of 0.01 S/cm or more, and in which electrolyte membrane the water absorption at 80°C
20 (W80°C), the water absorption at 25°C (W25°C) and the ion exchange capacity satisfy the following formula (3):

$$(W80^{\circ}\text{C}/W25^{\circ}\text{C}) \leq 1.27 \times (\text{ICE}) - 0.78 \text{ (formula (3))}$$

W80°C: water absorption (% by weight) at 80°C

W25°C: water absorption (% by weight) at 25°C

25 IEC: ion exchange capacity (meq/g)

7. The electrolyte membrane-electrode assembly according to claim 3, wherein an electrolyte membrane is used which is a hydrocarbon-based ion exchange membrane

having an ion exchange capacity within the range of from 1.0 to 3.0 meq/g and exhibits a conductivity, measured under an atmosphere at 80°C and 95% relative humidity, of 0.01 S/cm or more, and in which electrolyte membrane the volume at 25°C and 65% relative humidity (V1), the volume after immersion in water at 25°C (V2) and the ion exchange

5 capacity satisfy the following formula (4):

$$(V2/V1) \leq 1.05 \times (IEC) - 0.38 \text{ (formula (4))}$$

V1: volume (cm^3) at 25°C and 65% relative humidity

V2: volume (cm^3) in 25°C water

IEC: ion exchange capacity (meq/g)

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8. The electrolyte membrane-electrode assembly according to claim 1, wherein an electrolyte membrane is used which is a hydrocarbon-based ion exchange membrane having an ion exchange capacity within the range of from 1.0 to 3.0 meq/g and exhibits a conductivity, measured under an atmosphere at 80°C and 95% relative humidity, of 0.01 S/cm or more and in which the tensile breaking strength (DT) measured in 25°C water and the ion exchange capacity satisfy the following formula (5):

$$DT \geq 135 - 55 \times (IEC) \text{ (formula (5))}$$

DT: tensile breaking strength (MPa)

IEC: ion exchange capacity (meq/g)

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9. The electrolyte membrane-electrode assembly according to claim 8, wherein an electrolyte membrane is used which is a hydrocarbon-based ion exchange membrane composed of a substantially single compound and exhibits a tensile strength of 40 MPa or more under an atmosphere at 20°C and 65% relative humidity and also exhibits a tensile strength measured in 25°C water of 30 MPa or more.

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10. The electrolyte membrane-electrode assembly according to claim 8, wherein an electrolyte membrane is used which is a hydrocarbon-based ion exchange

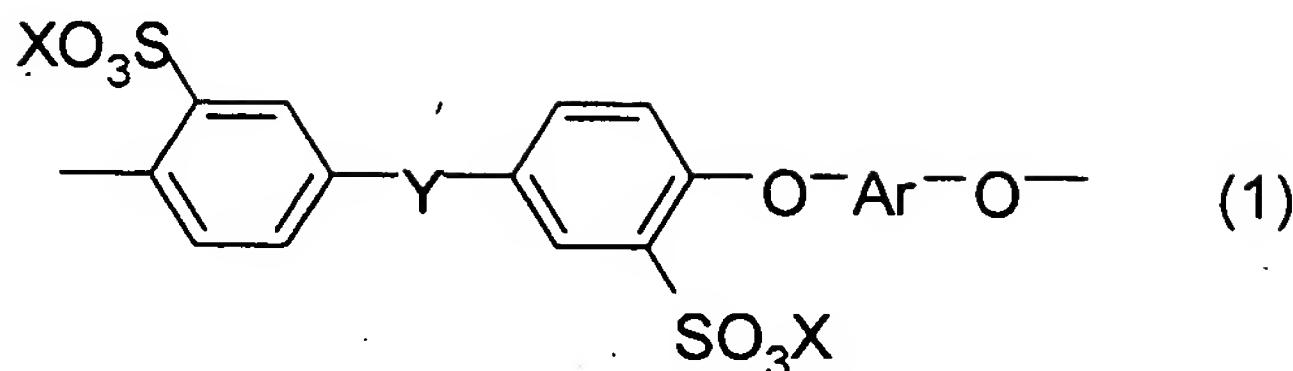
membrane composed of a substantially single compound and exhibits a tensile strength of 40 MPa or more under an atmosphere at 20°C and 65% relative humidity and which exhibits a difference between the tensile elongation measured in 25°C water and the tensile elongation measured in an atmosphere at 20°C and 65% relative humidity of
5 150% or less.

11. The electrolyte membrane-electrode assembly according to claim 8,
wherein an electrolyte membrane is used which is a non-perfluorocarbon sulfonic acid-based hydrocarbon-based ion exchange membrane for fuel cells using liquid fuel and
10 which electrolyte membrane exhibits a difference of 20% or less between the methanol permeation coefficients measured before and after the immersion of the ion exchange membrane in a 5 mol/l aqueous solution of methanol for 20 hours.

12. The electrolyte membrane-electrode assembly according to claim 11,
wherein an electrolyte membrane is used which is a non-perfluorocarbon sulfonic acid-based hydrocarbon-based ion exchange membrane for fuel cells using liquid fuel, which electrolyte membrane exhibits a difference of 20% or less between the methanol permeation coefficients measured before and after the immersion of the ion exchange membrane in a 5 mol/l aqueous solution of methanol for 20 hours, and which electrolyte
20 membrane has been subjected to a treatment of immersion in a solvent at a temperature of 80°C or higher.

13. The electrolyte membrane-electrode assembly according to any one of claims 1 to 12, wherein a poly(arylene ether)-based compound including a constituent represented by general formula (1) and a constituent represented by general formula (2)
25 is used as the organic polymer forming the electrolyte membrane:

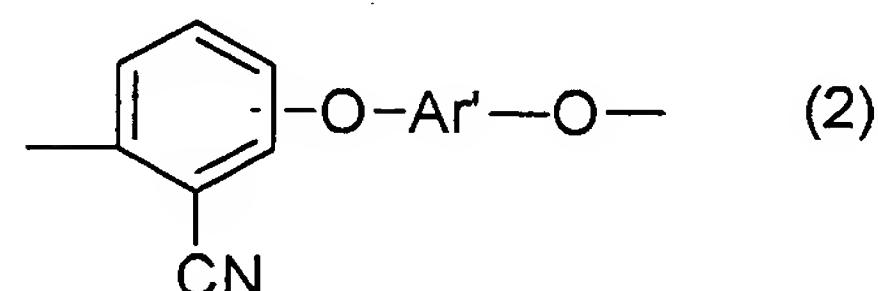
[chem. 8]



(in general formula (1), Ar represents a divalent aromatic group, Y represents sulfone group or a ketone group, and X represents H or a monovalent cationic group);

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[chem. 9]



(in general Ar' represents a divalent aromatic group).

14. A fuel cell using the electrolyte membrane-electrode assembly according to
10 any one of claims 1 to 12

15. A fuel cell using the electrolyte membrane-electrode assembly according to
claim 13.

15 16. A method for producing an electrolyte membrane-electrode assembly by
joining a hydrocarbon-based solid polymer electrolyte membrane and a pair of electrodes,
wherein the hydrocarbon-based solid polymer electrolyte membrane is joined with the
electrodes by hot pressing while the content of water contained in the hydrocarbon-
based solid polymer electrolyte membrane is within the range of from 10 to 70% of the
20 maximum water content of the hydrocarbon-based solid polymer electrolyte membrane.

17. The method for producing an electrolyte membrane-electrode assembly

according to claim 16, wherein the hydrocarbon-based solid polymer electrolyte membrane is provided with moisture through the holding of the hydrocarbon-based solid polymer electrolyte membrane in an atmosphere where the humidity and/or the temperature is controlled.